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PROCESS FOR THE REMOVAL OF SODIUM OXALATE FROM SOLUTIONS OF SODIUM ALUMINATE FROM THE BAYER CYCLE

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(57) Claim

1. A process for the removal of sodium oxalate from at least a fraction of the solution or liquor of sodium aluminate which is taken off in the Bayer cycle for the production of alumina from bauxite after the steps of decomposition and concentration of said liquor which is intended to be recycled as an alkaline liquor for attacking the bauxite ore, comprising precipitation of the dissolved sodium oxalate by means of an agent for destabilisation of the state of supersaturation of the sodium oxalate, then separation by filtration of the sodium oxalate which is precipitated in that way, characterised in that the agent for destabilisation of the state of supersaturation of the sodium oxalate, also acting as a filtration additive, which is brought into contact for more than one hour with the solution of sodium aluminate which is cooled at between 40°C and 60°C, is based on finely divided lime.

Removal of oxalates using lime

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COMPLETE SPECIFICATION

FOR A STANDARD PATENT

ORIGINAL

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Invention Title: Process for the Removal of Sodium Oxalate from
Solutions of Sodium Aluminate from the Bayer Cycle

The following statement is a full description of this invention, including the
best method of performing it known to me/us:-

**PROCESS FOR THE REMOVAL OF SODIUM OXALATE
FROM SOLUTIONS OF SODIUM ALUMINATE FROM THE BAYER CYCLE**

TECHNICAL FIELD

The invention concerns a process for the removal of sodium oxalate contained in solutions of sodium aluminate resulting from the alkaline attack on bauxites using the Bayer process.

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STATE OF THE ART

The Bayer process which is widely described in the specialist literature constitutes the essential procedure for the production of alumina which is intended to be converted into aluminium by igneous electrolysis. In accordance with the process the bauxite ore is treated in the hot condition by means of an aqueous solution of sodium hydroxide at a suitable level of concentration, thus causing solubilisation of the alumina and the production of a supersaturated solution of sodium aluminate. After separation of the solid phase constituting the unattacked residue (red muds) of the ore, the supersaturated solution of sodium aluminate, which is also referred to as the Bayer liquor, is decomposed by seeding with particles of aluminium trihydroxide in order to cause precipitation in the form of aluminium trihydroxide of the aluminium in solution. The alumina-depleted sodium aluminate liquor is then recycled to the attack step after having been concentrated and re-charged with sodium hydroxide in order to restore the level of concentration which is suitable for the operation of carrying out the attack on the ore. However, at the same time as the alumina of the bauxite is dissolved in the state of sodium aluminate, the supersaturated solution of sodium aluminate, which issues from the attack operation, becomes progressively charged with organic compounds produced by more or less complete decomposition of the humic materials contained in the ore. Those organic compounds which are degraded in the form of organic salts of

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purified liquor is then re-introduced into the Bayer cycle while a fraction of the solid phase of sodium oxalate is used for preparation of the suspension of seed crystals, the other fraction being removed from the cycle.

5 Although that seeding process is found to be effective for causing precipitation of the sodium oxalate, it suffers from disadvantages when applied industrially. In fact the sodium oxalate crystals constituting the seed become fairly quickly inactive due to poisoning of their surface by the organic materials present and it is
10 then expedient to effect washing of that seed, which is a highly delicate operation to carry out. In the case where the washing operation is found to be inadequate, there is found to be a fall in the activity of the seed and thus a reduction in the sodium oxalate precipitation yield. In the situation where the washing operation is
15 taken to excessive lengths, it is found that the granulometry of the seed is fined down, and that results in liquid-solid separation operations being highly difficult and thus involving falls in the purification yield.

 Instead of providing for destabilisation of the Bayer liquor
20 which is supersaturated with sodium oxalate by means of a sodium oxalate seed, US patent No 4 597 952 (EP-A-O 173 630) recommends the use of seeds of calcium oxalate or barium oxalate, the mode of action of which leads indirectly to the same result. In fact, calcium or barium oxalate which are unstable in the strongly alkaline Bayer
25 liquor liberate the oxalate ion to form sodium oxalate which contributes to increasing the level of concentration of sodium oxalate in solution beyond the critical supersaturation threshold, thus causing precipitation of the sodium oxalate. The amount of oxalate dissolved is thus restored to the limit of solubility of the
30 oxalate under the conditions of the experiment, dependent in particular on the temperature of the liquor and the concentration of sodium hydroxide in the liquor.

This process also results in the production of sodium oxalate precipitates which are finely dispersed in the Bayer liquor and which are therefore difficult to separate by settlement and/or filtration without the aid of additives. Likewise the seed recycling operation is necessary and a part of the precipitated sodium oxalate therefore has to be recycled in order to regenerate the calcium or barium oxalate seed after removal of the entrained organic materials. That regeneration operation is carried out by at least partially putting the precipitated sodium oxalate back into aqueous solution and treating the suspension obtained by means of lime (CaO) or barium aluminate ($\text{Al}_2\text{O}_4\text{Ba}$). That treatment results in the production of a precipitate of calcium oxalate or barium oxalate, which is recycled to the sodium oxalate precipitation stage.

15 STATEMENT OF PROBLEM

It is therefore in order to deal with the dual problem of separation of the precipitated fines of sodium oxalate in the Bayer liquor and recycling of the oxalate seeds, while maintaining the level of effectiveness and in particular selectivity of the processes for the precipitation of sodium oxalate by the addition of oxalates seed, that the applicants studied and developed the process according to the invention.

SUBJECT OF THE INVENTION

25 The invention is based on the discovery that, taking a heterogenous seed based on finely divided lime, it is possible to cause substantial precipitation of sodium oxalate in the Bayer liquor in the form of a precipitate which can be easily separated by filtration, without the addition of a filtration additive.

30 For selectively precipitating the sodium oxalate without entraining humic materials and thus not randomly modifying the critical supersaturation threshold of the sodium oxalate in the Bayer

liquor as well as the filtrability properties of that liquor, it is expedient to operate under clearly defined operating conditions, in particular as regards the temperature at which the precipitation operation in the liquor is effected.

5 More precisely the invention concerns a process for the removal of sodium oxalate from at least a fraction of the solution or liquor of sodium aluminate which is taken off in the Bayer cycle for the production of alumina from bauxite after the steps of decomposition and concentration of said liquor which is intended to be
10 recycled as an alkaline liquor for attacking the bauxite ore, comprising precipitation of the dissolved sodium oxalate by means of an agent for destabilisation of the state of supersaturation of the sodium oxalate, then separation by filtration of the sodium oxalate which is precipitated in that way, characterised in that the agent
15 for destabilisation of the state of supersaturation of the sodium oxalate, also acting as a filtration additive, which is brought into contact for more than one hour with the solution of sodium aluminate which is cooled at between 40°C and 60°C, is based on finely divided
lime. Magnesia is optionally added to that lime in a proportion
20 which does not exceed 40% by weight of the mixture which is formed in that way.

It has in fact been surprisingly found that the lime which is sometimes used as a filtration additive to facilitate the separation of certain solid impurities from the Bayer liquor could very
25 effectively replace the seeds of sodium, barium or calcium oxalates recommended by the prior art, at between 40°C and 60°C. By virtue of the very strongly alkaline character of the Bayer liquor after decomposition and concentration and up to 60°C, there cannot be any combination of the lime with the elements in solution in the liquor,
30 in particular with the oxalate ion $C_2O_4^{--}$ and the humic materials which remain in solution. It is to be noted that the lime can be brought into contact with the sodium aluminate solution in the form

of quicklime CaO or in the form of milk of lime whose concentration of CaO is between 100 and 300 g/litre, but in no case is the equilibrium of solubility of the sodium oxalate altered. It must be admitted that the lime essentially acts as a seed for precipitation of the oxalate in supersaturated solution due just to the mechanical effect of liquor/solid contact, which in the present case is considerable having regard to the large surface area developed by the finely divided lime in contact with the liquor. It is to be noted however that beyond 60°C that seeding effect quickly decreases and is no longer perceptible at 70°C.

In parallel in the temperature range of 40°C - 60°C, after a sufficient contact time to permit precipitation of the small crystals of sodium oxalate in suspension with the particles of lime, it is found that the solid phase which is obtained in that way can be easily filtered. In follows that, after drying of the insoluble cake to recover the maximum amount of impregnation liquor, the latter no longer contains materials which can be put to valuable use, and it can be completely dumped. This is unlike processes using an oxalate seed which has to be recovered at least in part and regenerated by means of complex treatments.

It should also be recalled that the critical supersaturation threshold as from which the sodium oxalate precipitates spontaneously decreases with a decrease in temperature. At less than 40°C, there can be a fear of untimely precipitations of very fine particles of sodium oxalate in the circuits outside the stations provided for that purpose, and those very fine particles are also found to be very difficult to filter off. If the increase in concentration of caustic soda in the liquor (concentration of free soda + combined soda in AlO_2Na expressed in terms of Na_2O g/l) tends also to reduce the critical supersaturation threshold for sodium oxalate, it is influenced in particular by the presence of humic materials which are only slightly degraded in the liquor. That threshold rising in

proportion to the charge of organic materials in the liquor, it can easily be concluded that the process according to the invention will enjoy increased effectiveness with a rising threshold and that therefore the amount of oxalate which can be precipitated is great
5 for a given volume of liquor. That is the reason why the invention finds one of its best applications when treating tropical trihydrate bauxites. Such bauxites which are based on hydragillite and which are rich in humic materials undergo an alkaline attack at a temperature which is generally $\leq 150^{\circ}\text{C}$ so that the attack liquor is
10 progressively enriched with sodium oxalate, as a consequence of degradation of the humic materials in time. Accordingly the amount of soluble sodium oxalate can attain from 0.3 to 0.6% by weight of oxalic carbon in relation to caustic soda (free soda + soda in the state of AlO_2Na) before being restored after precipitation in
15 accordance with the process of the invention to amounts of from 0.15 to 0.25%. It will also be noted that, in the case of monohydrate bauxite containing little humic materials and which moreover are attacked at high temperature ($\geq 200^{\circ}\text{C}$), the critical supersaturation threshold does not exceed 0.15 to 0.25% by weight of oxalic carbon
20 relative to the caustic soda by virtue of the presence in a very greatly reduced amount in the liquor of humic materials. That threshold can be artificially raised to 0.3 or 0.5% by the addition to the liquor, at any point in the Bayer cycle, of an anionic synthesis polyelectrolyte such as polyacrylamide, or polyacrylic acid, in
25 accordance with the teaching of the present applicants' EP 0 173 630 (US No 4 597 952). The retarding action on the precipitation of sodium oxalate by that synthesis agent, which is similar to that of the only slightly degraded organic or humic materials naturally present in the Bayer liquor makes it possible to apply the process of
30 the present invention to all bauxites with the same effectiveness as for tropical trihydrate bauxites.

Generally speaking the treatment for the removal of oxalate from the Bayer liquor which is decomposed and then concentrated to reach a concentration of caustic soda expressed in terms of caustic Na_2O of between 170 and 250 g/litre and a concentration of sodium oxalate expressed in terms of oxalic carbon relative to the caustic soda of between 0.3 and 0.6% is effected only on a fraction representing from 3 to 20% of the total volume of the liquor after concentration and at a temperature of between 40 and 60°C, therefore requiring that fraction of the Bayer to be cooled. The quicklime in which about 2% by weight of the grains is smaller than 10 micrometres or the milk of lime in which about 20% of the grains is smaller than 10 micrometres, is introduced regularly into the cooled liquor which is maintained in an agitated state to form a highly homogenous dispersion of lime at a concentration of CaO of between 2 and 20 g per litre of liquor. For that purpose, after the introduction of lime, the suspension is still kept in an agitated state for more than 1 hour. The solid phase of the suspension which is then formed by a mixture of fine particles of lime and crystallised sodium oxalate is separated by settlement and filtration or direct filtration. It is to be noted that separation is relatively easy since it is possible to collect at least 36 kg of dried cake per hour per m^2 of filtering surface area with a proportion of free soda expressed as $\text{Na}_2\text{O} < 3\%$ of the dried moist cake. After separation the solid phase without useful material can be added to the red muds to be discarded while the liquor in which the reduced concentration of soluble sodium oxalate is less than 0.25% of oxalic carbon relative to the caustic soda is added to the main fraction of liquor from which oxalate has not been removed to form a strongly alkaline solution which is recycled as a bauxite attack liquor.

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CARRYING THE INVENTION INTO EFFECT

The way in which the invention is performed under the

preferred operating conditions will be better appreciated from the description based on the general treatment diagram (Figure 1).

As shown in Figure 1, the Bayer liquor L₀, possibly with the addition prior to the decomposition step of an anionic polyelectrolyte l₀, for example FLOERGER (R) type AN934SH, in a proportion of 20 mg per litre of solution, to raise if necessary the critical supersaturation threshold of oxalate to the vicinity of 0.5% of oxalic carbon with respect to the caustic soda is decomposed and after separation of the aluminium trihydroxide precipitated, the resulting liquor L₁ is concentrated by evaporation in such a way that the concentration of caustic soda is between 170 and 250 g of Na₂O/litre and preferably between 190 and 210 g of Na₂O/litre.

A fraction L₄ which preferably represents from 4 to 6% of the volume of concentrated liquor L₂ is taken off to be subjected to the de-oxalation treatment according to the invention. The magnitude of the fraction L₄ which is taken off is determined by the amount of sodium oxalate which is to be removed in each cycle to avoid a progressive increase in the content of sodium oxalate in the Bayer liquor and any risk of untimely precipitation of that oxalate on the aluminium trihydroxide grains in the decomposition operation. It should be recalled that the increase in the content of oxalate in the Bayer liquor, which is more or less rapid depending on the nature and the origin of the bauxite, is caused by the oxalates present in the oxide ore going into solution in the alkaline attack operation, but also progressive degradation in the form of sodium oxalate of the organic materials which are already solubilised in the recycled Bayer liquor.

After cooling to a temperature of between 40°C and 60°C the cooled liquor L₅ whose critical supersaturation threshold is attained or even exceeded, by virtue of the reduction in temperature, is brought into contact in a first agitated reactor R₁ with finely divided quicklime So to form a homogenous suspension of a

concentration which is preferably between 7 and 9 g of CaO per litre of liquor L5.

The suspension S1 which is formed in that way is transferred into a second agitated reactor and then into a third agitated reactor 5 R3. The total time of quicklime-liquor contacting which in the present case is effected in the three reactors in series is preferably between 3 and 5 hours. The suspension S3 which issues from the reactor R3 is filtered. That filtration operation which is carried out over a filter press is very quick, of the order of 1.5 10 m³/hour of suspension per m² of filtering surface area.

After filtration and drying the cake S4 of insoluble materials, whose content of free Na₂O is less than 3%, is mixed with the red muds to be discharged. The liquor L6 with a reduced sodium oxalate content, at a level of concentration of between 0.15 and 15 0.25% of oxalic carbon with respect to the caustic soda, is mixed with the main fraction L3 of non-de-oxalated liquor to form an alkaline liquor L7 which is recycled as a bauxite ore attack liquor.

EXAMPLES OF USE

20 Example 1

The treatment according to the process of the invention was applied to 40 m³/hour of industrial liquor L4 taken from the circuit of decomposed and concentrated liquor L2 whose flow rate is 1000 m³/hour and which essentially derives from the alkaline attack at a 25 temperature of 105°C on a tropical trihydrate bauxite. The liquor L4 taken off was of the following composition:

Caustic Na ₂ O	: 200 g/l
Carbonated Na ₂ O	: 25 g/l
Al ₂ O ₃	: 120 g/l
Sodium oxalate expressed as oxalic C	: 0.90 g/l
Proportion of oxalic C/caustic Na ₂ O	: 0.45%

30 After cooling to 40°C, the cooled liquor L5 is mixed with 270

kg of quicklime with the addition of 30 kg of magnesia in a first agitated reactor to form a homogenous suspension of a concentration of 8 g of $\text{CaO} + \text{MgO}$ /litre. After 3 hours of contact in the agitated reactor the suspension representing a volume of 40 m^3 was filtered in less than 1 hour over a filter of an area of 30 m^2 . After drying the insoluble moist cake S4 titrated less than 3% of free soda expressed as Na_2O and the liquor L6 which was returned to the Bayer circuit to be mixed with the 960 m^3 of non-deoxalated liquor L3 which was recycled as the attack liquor contained only 0.37 g of oxalic carbon per litre, that is to say oxalic C/caustic $\text{Na}_2\text{O} = 0.18\%$.

In that treatment $(0.88 - 0.37) 4.10^4 \text{ g}$, that is to say about 20.4 kg of oxalic carbon corresponding to 113.8 kg of crystallised sodium oxalate was removed in the course of the cycle.

15 Example 2

The treatment carried out under the conditions of Example 1 was applied to 40 m^3 /hour of industrial liquor L4 resulting from the attack at a temperature of 250°C of a monohydrate bauxite of Mediterranean origin. The liquor L4 whose critical supersaturation threshold in respect of sodium oxalate has been raised to 0.68 g/l of oxalic carbon by the addition in a proportion of 20 mg/litre of anionic polyelectrolyte Floerger AN 934 SH, was of the following composition:

25	Caustic Na_2O : 195 g/l
	Carbonated Na_2O : 22 g/l
	Al_2O_3 : 120 g/l

Sodium oxalate expressed as oxalic C : 0.58 g/l corresponds to a proportion of oxalic C/caustic Na_2O of 0.30% substantially lower than the critical supersaturation threshold of 0.68 g/l corresponding to the proportion of 0.35%.

After filtration in less than 1 hour and drying, the moist insoluble cake S4 titrated less than 3% of free soda expressed as Na_2O and the de-oxalated liquor L6 contained only 0.19 g of oxalic carbon per litre, that is to say a proportion of oxalic C/caustic Na_2O of 0.18%.

In that treatment $(0.58 - 0.19) 4.10^4$ g, that is to say about 15.6 kg of oxalic carbon corresponding to 87 kg of crystallised sodium oxalate, was removed in the course of the cycle.

10 Example 3

The treatment according to the process of the invention was applied to $40 \text{ m}^3/\text{hour}$ of industrial liquor L4 taken from the circuit of decomposed and concentrated liquor L2 whose flow rate is $1000 \text{ m}^3/\text{hour}$ and which essentially comes from the alkaline attack at a temperature of 105°C on a tropical trihydrate bauxite. The liquor L4 taken off was of the following composition:

	Caustic Na_2O	: 205 g/l
	Carbonated Na_2O	: 24 g/l
	Al_2O_3	: 120 g/l
20	Sodium oxalate expressed as oxalic C	: 0.88 g/l
	Proportion of oxalic C/caustic Na_2O	: 0.43%

After cooling to 40°C , the cooled liquor L5 is mixed with 270 kg of quicklime with the addition of 30 kg of magnesia thereto in a first agitated reactor to form a homogenous suspension of a concentration of 8 g of $\text{CaO} + \text{MgO}/\text{litre}$. After 3 hours of contact in the agitated reactor the suspension representing a volume of 40 m^3 was filtered in less than 1 hour over a 30 m^2 filter. After drying the moist insoluble cake S4 titrated less than 3% of free soda expressed as Na_2O and the liquor L6 returned to the Bayer circuit to be mixed with the 960 m^3 of non-de-oxalated liquor L3 recycled as the attack liquor contained only 0.37 g of oxalic carbon per litre, that is to say oxalic C/caustic $\text{Na}_2\text{O} = 0.18\%$.

In that treatment $(0.88 - 0.37) 4.10^4$ g, that is to say about 20.4 kg of oxalic carbon corresponding to 113.8 kg of crystallised sodium oxalate, was removed in the course of the cycle.

5 Example 4

This Example involved treating a second aliquot portion L4 of the liquor L2 of Example 3 under the same precipitation conditions as those of Example 3 except for the temperature of the liquor which was maintained at 80°C instead of 40°C. Independently of the less good permeability of the insoluble cake as specifically manifested by an increase in the filtration times at constant volume (1h10' for 40 m³ of liquor to be filtered), there was noted an insignificant reduction in the proportion of sodium oxalate expressed as oxalic C of 0.88 g/l in the initial liquor to 0.86 g/l in the filtered liquor. On the other hand the proportion of organic carbon controlled at 7.2 g/l in the initial liquor is reduced to 5.3 g/l in the filtered liquor, confirming partial purification in respect of organic or humic materials which are slightly degraded, precipitated or insolubilised, probably by the lime-magnesia mixture. It is therefore confirmed that, under those conditions, the addition of a lime-based seed has no effect on the amount of oxalate in the liquor.

Example 5

This Example involved treating a third aliquot portion L4 of the liquor L2 of Example 3 under the same precipitation conditions as those of Example 3, except for the temperature which was maintained at 60°C and the composition of the 300 kg of stabilising agent which in the present case is formed by a mixture of 180 kg of CaO and 120 kg of MgO (60%/40% by weight). Good filtrability of the insoluble cake was noted, as in Example 3, as well as a significant reduction in the proportion from 0.88 g/l to 0.39 g/l corresponding to oxalic C/caustic Na₂O = 0.19% and the removal in the course of a treatment

cycle on 40 m³ of liquor of (0.88 - 0.39) 4.10⁴ g, that is to say approximately 19.6 kg of oxalic carbon corresponding to 109.4 kg of crystallised sodium oxalate.

5 In parallel it is found that there is a slight reduction in the amount of organic carbon from 7.2 g/l in the initial liquor to 6.7 g in the filtered liquor after de-oxalatation, leading to the supposition that slightly degraded humic or organic materials are beginning to be insolublised.

CLAIMS

The claims defining the invention are as follows:

1. A process for the removal of sodium oxalate from at least a fraction of the solution or liquor of sodium aluminate which is taken off in the Bayer cycle for the production of alumina from bauxite after the steps of decomposition and concentration of said liquor which is intended to be recycled as an alkaline liquor for attacking the bauxite ore, comprising precipitation of the dissolved sodium oxalate by means of an agent for destabilisation of the state of supersaturation of the sodium oxalate, then separation by filtration of the sodium oxalate which is precipitated in that way, characterised in that the agent for destabilisation of the state of supersaturation of the sodium oxalate, also acting as a filtration additive, which is brought into contact for more than one hour with the solution of sodium aluminate which is cooled at between 40°C and 60°C, is based on finely divided lime.
2. A process according to claim 1 characterised in that the destabilisation agent is lime with the addition of magnesia in a proportion not exceeding 40% by weight of the mixture which is formed in that way.
3. A process according to claim 1 characterised in that the destabilisation agent is quicklime in which about 2% by weight of the grains are smaller than 10 micrometres.
4. A process according to claim 1 characterised in that the destabilisation agent is a milk of lime in which the concentration of CaO is between 100 and 300 g/litre and in which about 20% by weight of the grains of lime in suspension are smaller than 10 micrometres.
5. A process according to claim 1 characterised in that the

solution or liquor of sodium aluminate which is taken off after decomposition and concentration is of a concentration of caustic soda expressed as Na_2O of between 170 and 250 g/l and preferably between 190 and 210 g/l.

6. A process according to claim 1 or claim 5 characterised in that the solution or liquor of sodium aluminate which is taken off after decomposition and concentration has a proportion of sodium oxalate expressed by the ratio by weight of oxalic carbon/caustic Na_2O of between 0.3% and 0.6% and preferably between 0.3% and 0.5%.

7. A process according to any one of claims 1, 5 and 6 characterised in that the fraction of concentrated liquor taken off represents from 3 to 20% and preferably from 4 to 6% of the total volume of concentrated liquor.

8. A process according to any one of claims 1 to 7 characterised in that the homogenous suspension of lime in the cooled liquor is of a concentration of between 2 and 20 g and preferably between 7 and 9 g of CaO per litre.

9. A process according to any one of claims 1 to 8 characterised in that the time involving contact of the lime with the cooled liquor for forming a suspension which is maintained in an agitated state is preferably between 3 and 5 hours.

10. A process according to any one of claims 1 to 6 characterised in that after a CaO /liquor contact time of at least 1 hour the solid phase of the suspension after filtration and drying is discarded while the liquid phase which is formed by the liquor with the reduced oxalate content is recycled mixed with the main fraction of non-de-oxalated liquor as the bauxite ore attack liquor.

11. A process according to claim 1 characterised in that an anionic polyelectrolyte is previously added to the solution or liquor of sodium aluminate in any step in the Bayer cycle and preferably prior to decomposition, if the critical supersaturation threshold in respect of sodium oxalate in the liquor which is taken off does not exceed 0.15 to 0.25% by weight of oxalic carbon with respect to the caustic soda.

12. A process according to claim 1 characterised in that the amount of anionic polyelectrolyte added is of the order of 20 mg per litre of liquor.

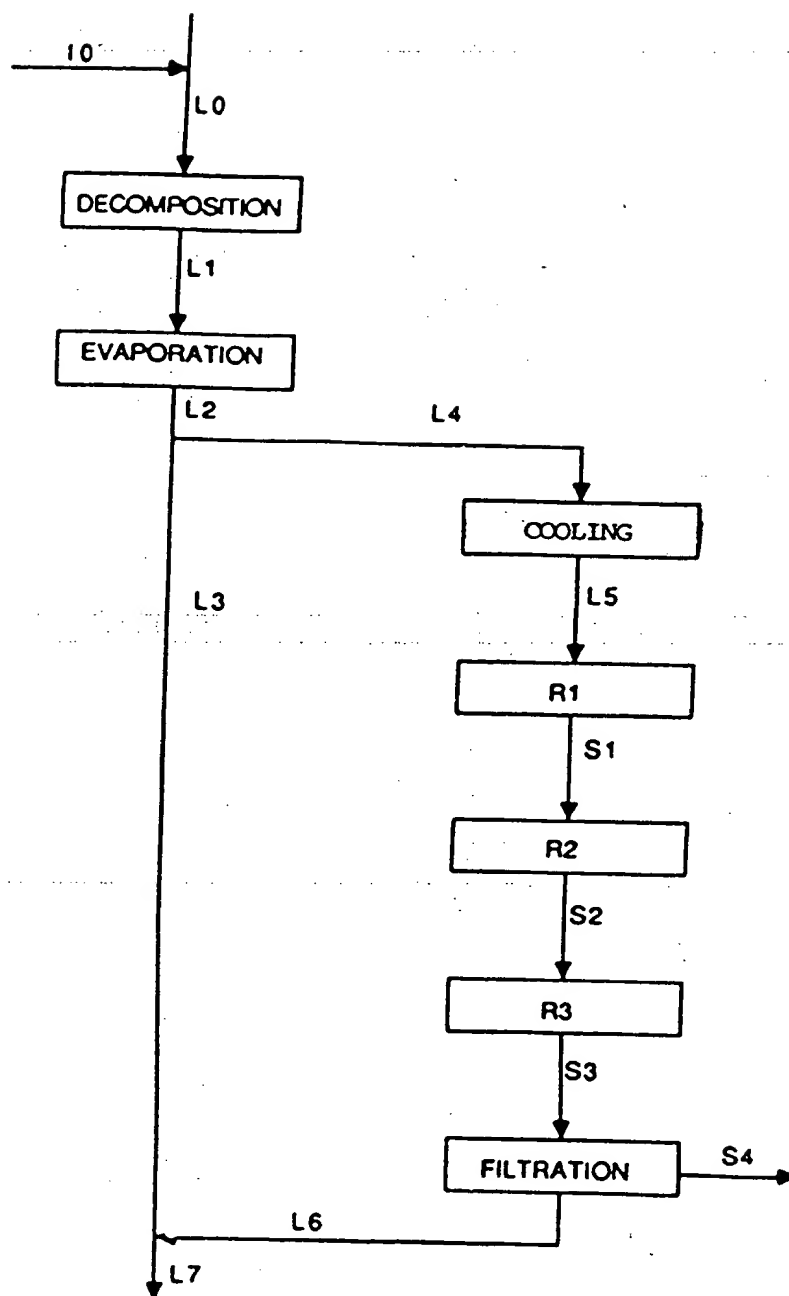
13. A process for the removal of sodium oxalate from at least a fraction of the solution or liquor of sodium aluminate which is taken off in the Bayer cycle for the production of alumina from bauxite after the steps of decomposition and concentration of said liquor which is intended to be recycled as an alkaline liquor for attacking the bauxite ore substantially as hereinbefore described with reference to any one of the Examples.

14. A process for the removal of sodium oxalate from at least a fraction of the solution or liquor of sodium aluminate which is taken off in the Bayer cycle for the production of alumina from bauxite after the steps of decomposition and concentration of said liquor which is intended to be recycled as an alkaline liquor for attacking the bauxite ore substantially as hereinbefore described with reference to the accompanying drawings.

Dated 3 February, 1993

Aluminium Pechiney

FIG.1



SPRUSON & FERGUSON

AUSTRALIA

PATENTS ACT 1990

PATENT REQUEST: STANDARD PATENT

I/We, the Applicant(s)/Nominated Person(s) specified below, request I/We be granted a patent for the invention disclosed in the accompanying standard complete specification.

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[54] Invention Title:

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Sodium Aluminate from the Bayer Cycle

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